

TEA2028B

COLOR TV SCANNING AND POWER SUPPLY PROCESSOR

DEFLECTION

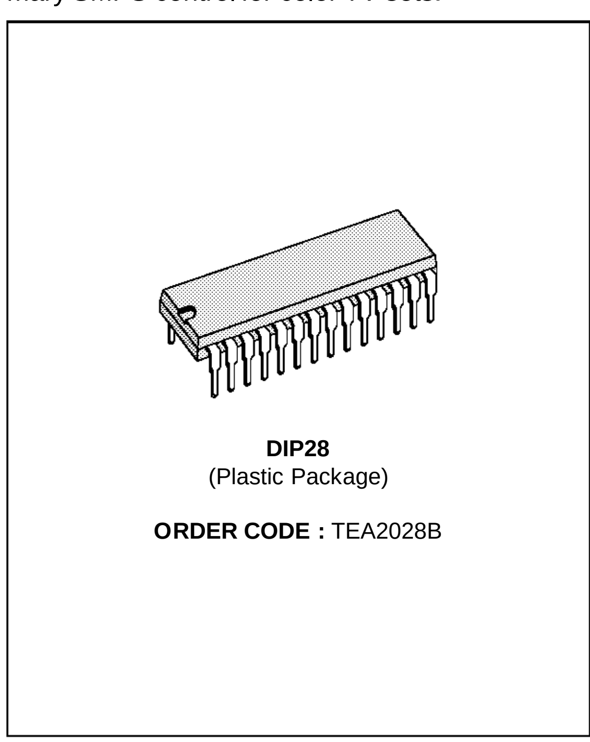
- CERAMIC 500kHz RESONATOR FREQUENCY REFERENCE
- NO LINE AND FRAME OSCILLATOR ADJUSTMENT REFERENCE
- DUAL PLL FOR LINE DEFLECTION
- HIGH PERFORMANCE SYNCHRONIZATION
- SUPER SANDCASTLE OUTPUT
- FRAME BLANKING WITH SAFETY CIRCUIT
- VIDEO IDENTIFICATION CIRCUIT
- AUTOMATIC 50/60Hz STANDARD IDENTIFICATION
- EXCELLENT INTERLACING CONTROL
- SPECIAL PATENTED FRAME SYNCHRO DEVICE FOR VCR OPERATION
- FRAME SAW-TOOTH GENERATOR

SMPS CONTROL

- ERROR AMPLIFIER AND PHASE MODULATOR
- SYNCHRONIZATION WITH HORIZONTAL DEFLECTION
- SECURITY CIRCUIT AND START-UP PROCESSOR
- OUTPUT PULSES ARE SENT TO THE PRIMARY SMPS IC TEA2261 THROUGH A LOW COST SYNCHRO PULSE TRANSFORMER

DESCRIPTION

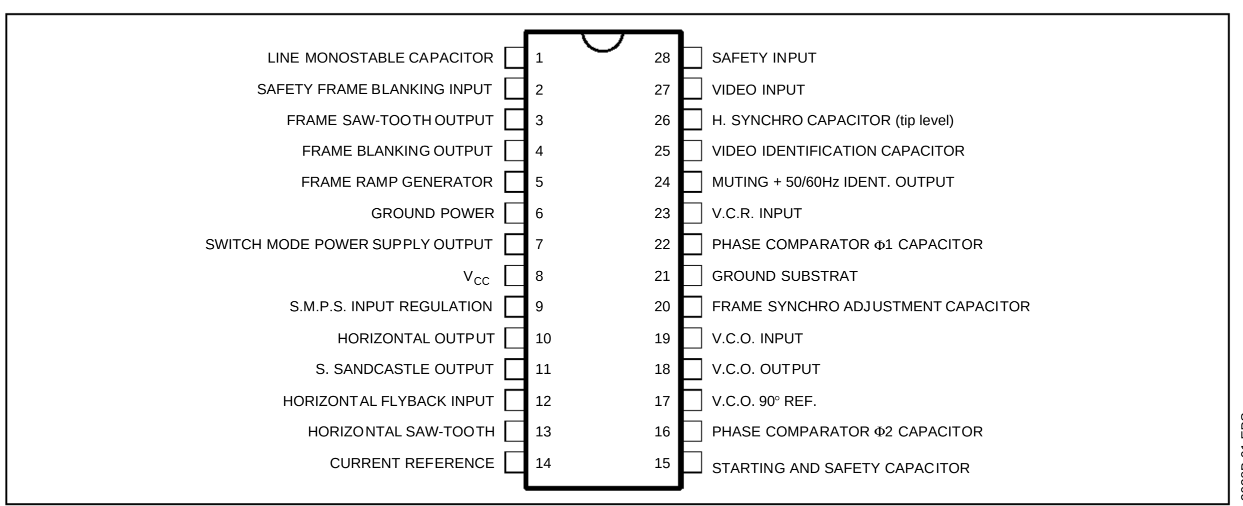
The TEA2028B is a complete (horizontal and vertical) deflection processor with secondary to primary SMPS control for color TV sets.



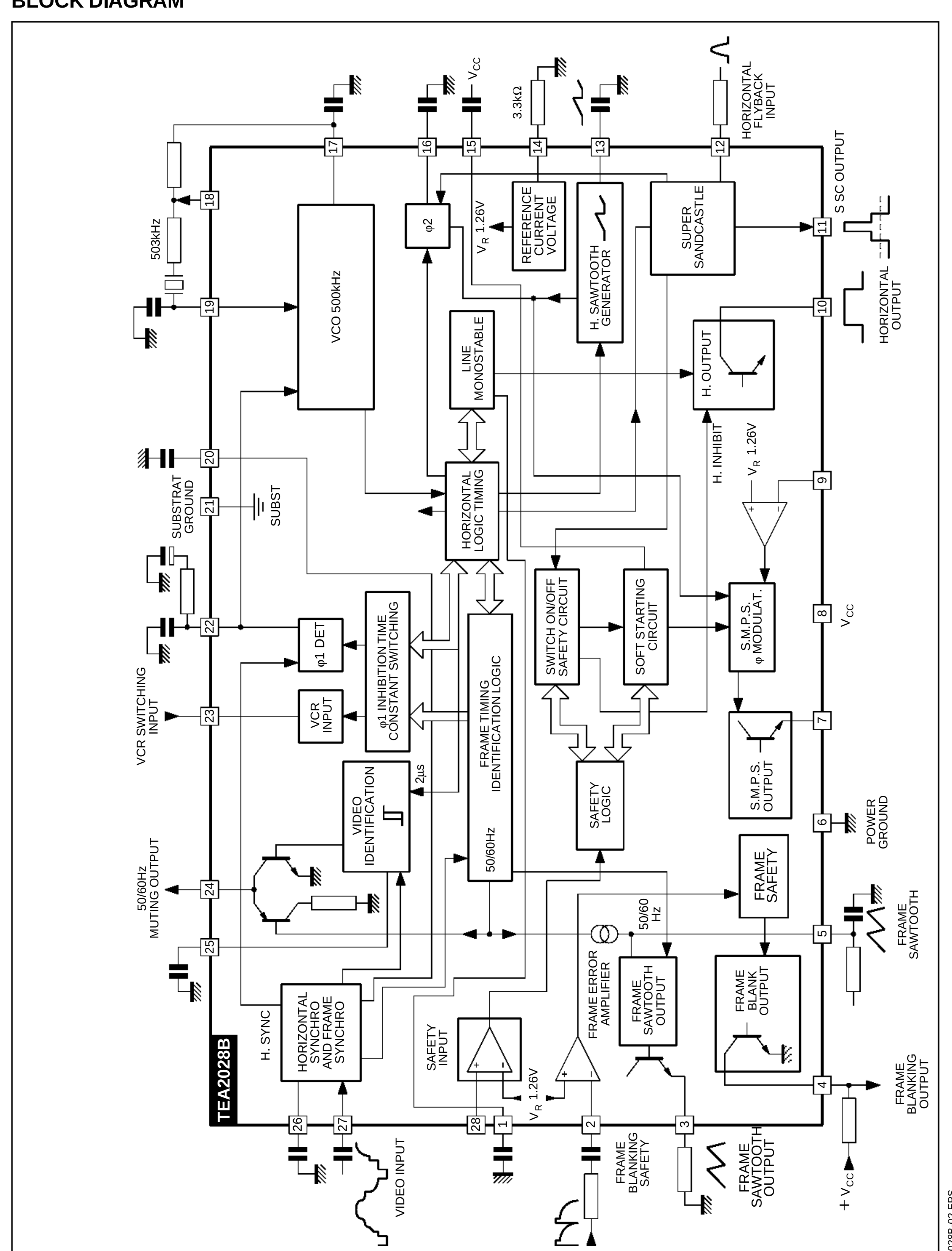
DIP28
(Plastic Package)

ORDER CODE : TEA2028B

PIN CONNECTIONS



BLOCK DIAGRAM



GENERAL DESCRIPTION

Introduction

This integrated circuit uses I^2L bipolar technology and combines analog signal processing with digital processing.

Timing signals are obtained from a voltage-controlled oscillator (VCO) operating at 500kHz by means of a cheap ceramic resonator. This avoids the frequency adjustment normally required with line and frame oscillators.

A chain of dividers and appropriate logic circuitry produce very accurately defined sampling pulses and the necessary timing signals.

The principal functions implemented are :
- Horizontal scanning processor.
- Frame scanning processor :
  B Class Power stage using an external power amplifier with fly back generator such as the TDA8170.
- Secondary switch mode power regulation.
- The SMPS output synchronize a primary I.C. TEA2261 at the mains part.
- This concept allows ACTIVE STANDBY facilities.
- Line and frame synchronization separation.
- Dual phase-locked loop horizontal scanning.
- High performance frame and line synchronization with interlacing control.
- Video identification circuit.
- Super sandcastle.
- Automatic 50-60Hz standard identification.
- VCR input for PLL time constant and frame synchro switching.
- Frame saw-tooth generator.
- Frame blanking output.
- Switching mode regulated power supply comprising error amplifier and phase modulator.
- Security circuit and start-up processor.
- 500kHz VCO.

The circuit is supplied in a 28 pin DIP case.
V_{CC} = 12V.

Synchronization Separator

Line synchronization separator is clamped to black level of input video signal with synchronization pulse bottom level measurement.

The synchronization pulses are divided centrally between the black level and the synchronization pulse bottom level, to improve performance on video signals in noise conditions.

Frame Synchronization

Time constant of Frame Separator can be adjusted by adding a capacitor pin 20.

The frame timing identification logic permits automatic adaptatio to 50 - 60Hz standards or non-interlaced video.

An automatic synchronization window width system provides :
- fast frame capture (6.7ms wide window),
- good noise immunity (0.4ms narrow window).

The internal generator starts the discharge of the saw-tooth generator capacitor so that it is not disturbed by line fly-back effects.

Thanks to the logic control, the beginning of the charge phase does not depend on any disturbing effect of the line fly-back.

A 32µs timing is automatically applied on standardized transmissions, for perfect interlacing.

In VCR mode, the discharge time is controlled by an internal monostable independent of the line frequency and gives a direct frame synchronization.

Horizontal Scanning

The horizontal scanning frequency is obtained from the 500kHz VCO.

The circuit uses two phase-locked loops (PLL) : the first one controls the frequency, the second one controls the relative phase of the synchronization and line fly-back signals.

The frequency PLL has two switched time constants to provide :
- capture with a short time constant,
- good noise immunity after capture with a long time constant.

The output pulse has a constant duration of 29µs (with C(pin 1) = 3.3nF), independent of V_{CC} and delay in switching off the scanning transistor.

Video Identification

The horizontal synchronization signal is sampled by a 2µs pulse within the synchronization pulse. The signal is integrated by an external capacitor.

The identification function provides three different levels :
- 0V : no video identification
- 6V : 60Hz video identification
- 12V : 50Hz video identification

This information may be used for timing research in the case of frequency or voltage synthetizer type receivers and for audio muting.

Super Sandcastle with 3 levels : burst, line fly-back, frame blanking

In the event of vertical scanning failure, the frame blanking level goes high to protect the tube.

Frame blanking time (start with reset of frame divider) is 21 lines.

VCR Input

This provides for continuous use of the short time constant of the first phase-locked loop (frequency). In VCR mode, the frame synchronization window widens out to a search window and there is no delay of frame fly-back (direct synchronization).



Frame Saw-tooth Generator

The current to charge the capacitor is automatically switched to 60Hz operation to maintain constant amplitude.

Switch Mode Power Supply (S.M.P.S) Secondary to Primary Regulation

This power supply uses a differential error amplifier with an internal reference voltage of 1.26V and a phase modulator operating at the line frequency. The power transistor is turned off by the falling edge of the horizontal saw-tooth.

The ”soft start” device imposes a very small conduction angle on starting up, this angle progressively increases to its nominal regulation value.
The maximum conduction angle may be monitored by forcing a voltage on pin 15. This pin may also be used for current limitation.

The output pulse is sent to the primary I.C. TEA2261 via a low cost synchro transformer.

Security Circuit And Start-up Processor

When the security input (pin 28) is at a voltage below 1.26V the two outputs are simultaneously cut off until this voltage reaches the 1.26V threshold again. In this case the switch mode power supply is restarted by the ”soft start” system.
If this cycle is repeated three times, the two outputs are cut off definitively. To reset the safety logic circuits, V_{CC} must be lower than 3.5V.
This circuit eliminates the risk to switch off the TV receiver in the event of a flash affecting the tube.
On starting up the horizontal scanning function comes into operation at V_{CC} = 6V. The power supply then comes into operation progressively.
On shutting down, the two functions are interrupted simultaneously after the first line fly back.

Frame Blanking Safety (Pin 2)

The frame blanking safety checks the normal of frame scanning.
In case of any problem pin 4 and pin 11 is at a high level (frame blanking) in order to protect the tube.

ABSOLUTE MAXIMUM RATINGS (limiting values) (T_{amb} = 25°C unless otherwise noted)

Symbol	Parameter	Min.	Max.	Unit
	Supply Voltage (pin 8)		14	V
V_{CC}	Operating Supply Voltage (pin 8)	Starting threshold	13.2	V
I_{24}	Video Identification Current (pin 24)		10	mA
V_{12}	Positive voltage (pin 12)	– 5		V
I_{12}	Line retrace current (pin 12)		+ 10	mA
I_{10}	Line Output Current (pin 10)	– 10	40	mA
I_3	Frame Saw-tooth Generator (pin 3)		20	mA
I_4	Frame Blanking Input Current (pin 4)		100	mA
I_7	SMPS Output Current (pin 7)	– 40		mA
I_{28}	Safety Input Current (pin 28)		5	mA
V_{28}	Safety Input Voltage (pin 28)		V_{CC}	

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THERMAL DATA

Symbol	Parameter	Value	Unit
$R_{th\ (j-a)}$	Junction-ambient Thermal Resistance	55	°C/W

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ELECTRICAL OPERATING CHARACTERISTICS

T_{amb} = 25°C, V_{CC} = 12V (unless otherwise noted) Pulse duration at 50% of the ampifier

Symbol	Parameter	Min.	Typ.	Max.	Unit
I_{CC}	Supply Current (pin 8) (frame, line and SMPS output without load)		50	80	mA
SYNC SEPARATOR (Pins 26-27)					
	Positive Video Input AC Coupled (output impedance of signal source < 200Ω)	0.2	1.8	3	V_{PP}
– I_{27}	Negative Clamping Current (during sync pulse)	-25	-40	-55	µA
I_{27}	Clamping Current	3	6	9	µA
	Pin for slicing level 0.2V < V_{27pp} < 2V (50% of sync amplitude)				
– I_{26}	Negative Current	0	-750	-1000	µA
I_{26}	Positive Current	17	25	36	µA

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ELECTRICAL OPERATING CHARACTERISTICS (continued)

T_{amb} = 25°C, V_{CC} = 12V (unless otherwise noted) Pulse duration at 50% of the ampifier

Symbol	Parameter	Min.	Typ.	Max.	Unit
FRAME SYNCHRO ADJUSTMENT (Pin 20) (V_{20} = 2.5V)					
I_{20H}	High Output Current (V_{27} = 12V)		7.2		µA
I_{20L}	Low Output Current (V_{27} = 0V)		– 2.8		µA
VCO (Pins 17-18 and 19)					
	Frequency control range after line divider (ceramic resonator : 503kHz)		15.30 to 16.10		kHz
PHASE COMPARATOR φ 1 (Pin 22)					
	Output Current Low Loop Gain	± 0.35	± 0.50	± 0.65	mA
	Output Current High Loop Gain	± 1	± 1.5	± 2	mA
	Window Pulse Width	7	10	13	µs
VCR SWITCHING (Pin 23)					
	Threshold Voltage VCR Operating	1.7	2.2	2.7	V
I_{23}	Input Current (V_{23} = 0, V_{CC} = 12V)	-0.030	-0.25	-1	mA
VIDEO IDENTIFICATION (Pin 24)					
V_{24}	Output Saturation Voltage (without video signal, I_{24} = 3mA)		0.2	0.6	V
V_{24}	Output Voltage (with 60Hz video signal, I_{24} = 2.5mA)	5	6.5	7.5	V
V_{24}	Output Voltage (with 50Hz video signal, I_{24} = 10µA)	11.0	11.5		V
VIDEO IDENTIFICATION (Pin 25)					
I_{25}	Output Current (charging the capacitor)	0.5	0.75	1	mA
t_{25}	Identification Time (charging the capacitor)	1.3	1.7	2.2	µs
V_{25}	Threshold (voltage changing from lower to higher value)	4	4.5	5	V
L_{HYS}	Hysteresis		350		mV
H-RAMP GENERATOR (Pin 13)					
I_{ch13}	Charge Current	185	200	215	µA
V_{I13}	Base Voltage of Saw-tooth			0.5	V
I_{dis13}	Discharge Current	3.5	7.0		mA
SUPER SANDCASTLE (Pin 11)					
V_{B11}	Burst key pulse level Output Voltage (I_{11} = – 5mA)	9			V
V_{L11}	Line Blanking Pulse Level Output Voltage (I_{11} = – 5mA)	4	4.5	5	V
V_{BT11}	Frame Blanking Pulse Level Output Voltage (and frame out of function) (I_{11} = – 5mA)	2	2.5	3	V
SUPER SANDCASTLE					
T_{B11}	Delay between middle of synch pulse (Pin 27) and leading edge of burst key pulse	2.3		3.0	µs
	Duration of burst key pulse	3.7	4	5	
T_{O11}	Delay Between SSC Cutting Level at Pin 12 and Line Blanking Pulse			0.35	
	Frame Blanking Time (start with reset of frame divider)		21		Line
POSITIVE LINE FLY BACK INPUT (Pin 12)					
	Delay between middle of synch pulse and middle of line retrace	2.1	2.6	3.1	µs
	Threshold for SMPS Safety	1.1			V
V_{bl12}	Threshold for Blanking		0.3		V
$V_{φ12}$	Threshold for PLL2		3		V
I_{12}	Input Current – 0.4 V < V_{12} < V_{bl12}		-20		µA
I_{12}	Input Current VbI12 < V_{12} <Vφ12		-10		µA
I_{12}	Input Current $V_{φ12}$ < V_{12} < V_{CC}	0		1	µA

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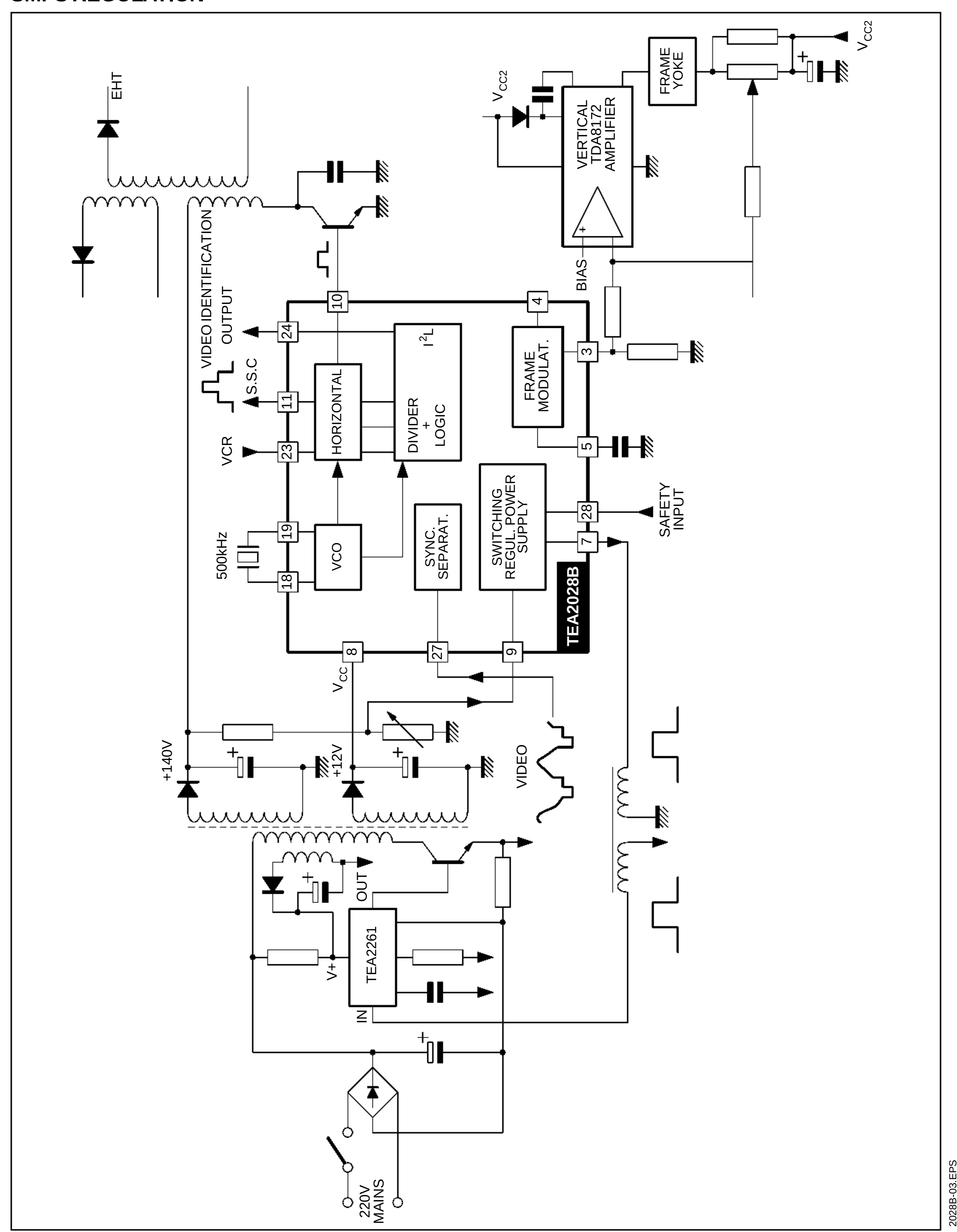
ELECTRICAL OPERATING CHARACTERISTICS (continued)

Symbol	Parameter	Min.	Typ.	Max.	Unit
PHASE COMPARATOR φ 2 (Pin 16)					
I_{16}	Charging Current	0.4	0.6	0.8	mA
I_{16}	Delay Between the Edges of φ 1 and φ 2 (f_{VCO} = 500kHz)		2.3		µs
LINE OUTPUT (open collector, Fvco = 500KHz) (Pin 10)					
	Output Voltage (I_{10max} = 20mA)		1	1.5	V
t_{10}	Output Pulse Duration (when fly-back pulse is with in time t_{10}) (with C (pin 1) = 3.3nF)	27.5	29	30.5	µs
Δt	φ 2 Phase Range	15	16	19	µs
FRAME LOGIC					
	Free Running Period (with mute signal)		315		Line
	Search Window	247		361	Line
	50 Hz Window	309		315	Line
	60 Hz Window	247		276	Line
	VCR Mode Window	247		361	Line
FRAME SAW-TOOTH GENERATOR (Pins 3-5)					
$I_5(60)$	Internal Current Generator (60Hz on)	12	14	16	µA
	Discharging Current	18	55		mA
V_s	Starting Level (0 < I_s < 10mA)	1	1.26	1.4	V
FRAME BLANKING SAFETY INPUT (Pin 2)					
	Threshold Voltage (negative going pulse)	1.15	1.26	1.37	V
FRAME BLANKING OUTPUT (open collector) - (Pin 4)					
	Output Saturation Voltage (I_4 = 5mA)			0.4	V
	Output Current (low level)			10	mA
	Blanking Time		21		Line
SMPS CONTROL INPUT (Pin 9)					
I_9	Input Current ($V_9 = V_{ref\ 14}$)			2	µA
SMPS OUTPUT (Pin 7) - No relation between end of SMPS pulse (pin 7) and leading edge of line fly back (pin 12)					
V_7	Output Voltage (0 < I_7 < 20mA)	10			V
t_7	t_{ON} max (f_{VCO} = 500kHz)	26	30	31	µs
	Output Phase Range	0		$t_{ON\ max}$	
SAFETY INPUT (Pin 28)					
V_{28}	Threshold Voltage ($V_{28} = V_{ref\ 14}$)	1.20	1.26	1.5	V
	Input Current (if $V_{28} < V_{ref\ 14}$ then SMPS and line are switched off during the next line retrace)			3	µA
Switch-on, Switch-off Processing (Pin 15)					
I_{ch15}	Charging Current (t_c = 4µs, T = 64µs)	70		130	µA
$\frac{I_{ch15}}{I_{dis15}}$	Ratio charging/discharging	0.8	1	1.2	µA
STARTING SUPPLY VOLTAGE (Pin 8)					
V_{CC}	SMPS* and Line Starting (Pins 7 and 10)	5.25		6.5	V
V_{CC}	SMPS Stopping During Line Retrace	5.25		6.5	V
V_{CC}	Frame and Line Stopping	5.25		6.5	V
V_{Hyst}	Hysteresis between Switching-on and Switching-off Level		450		mV
CURRENT REFERENCE (Pin 14)					
$V_{ref\ 14}$	Voltage Reference (R_{14} = 3.32KΩ ± 1%)	1.2	1.26	1.35	V

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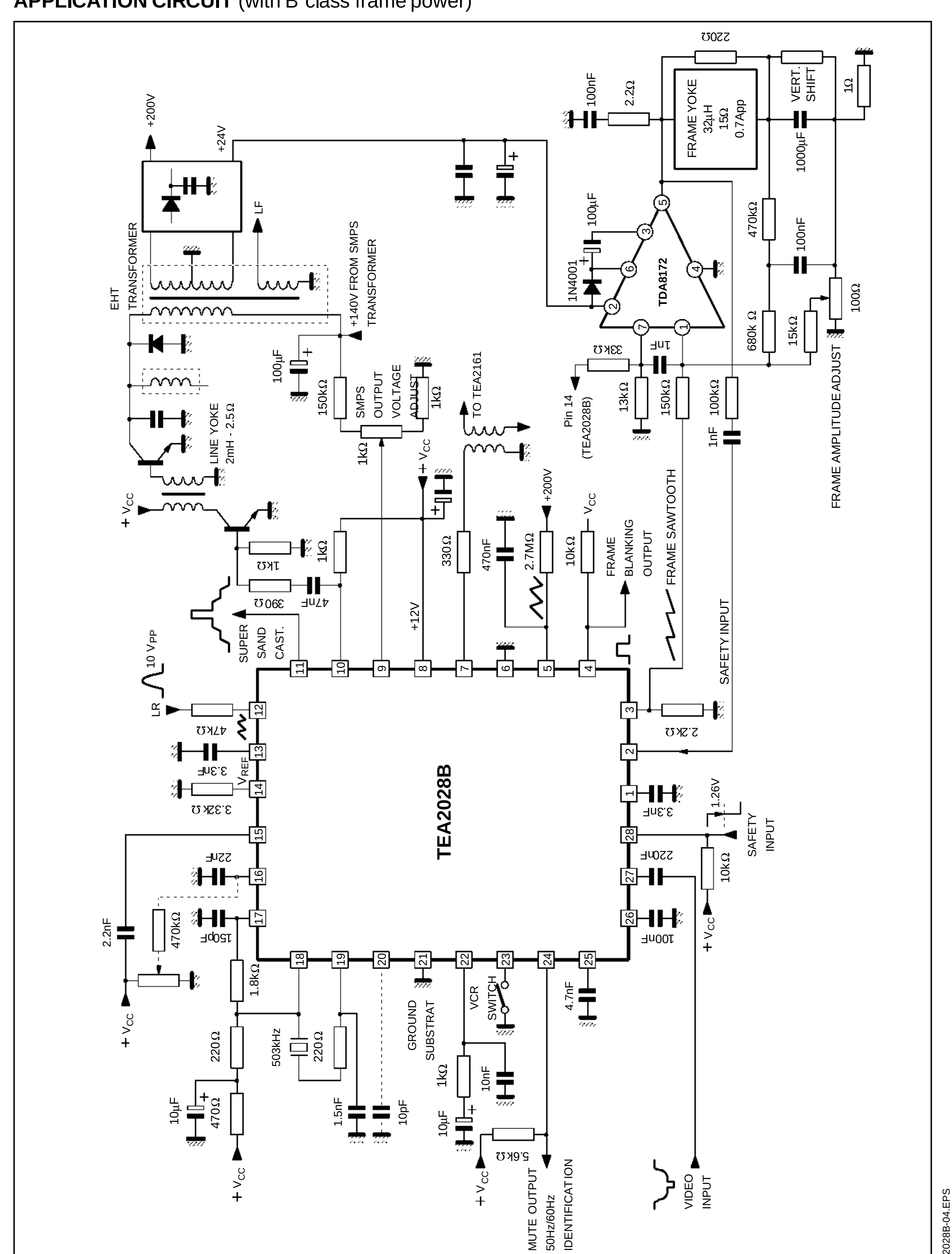
* Progressive Starting by Decreasing V_{15}

APPLICATION WITH TDA8172 FOR B CLASS FRAME POWER AND TEA2261 FOR SECONDARY SMPS REGULATION



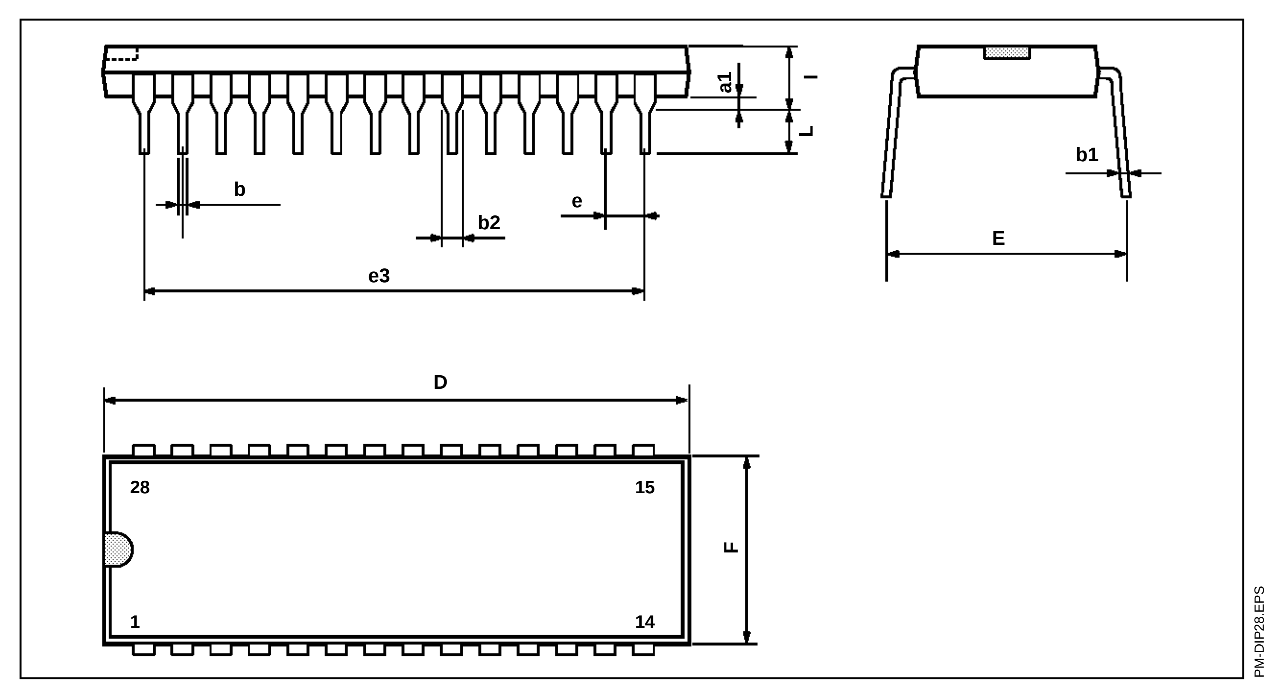
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APPLICATION CIRCUIT (with B class frame power)



PACKAGE MECHANICAL DATA

28 PINS - PLASTIC DIP



Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
a1		0.63			0.025	
b		0.45			0.018	
b1	0.23		0.31	0.009		0.012
b2		1.27			0.050	
D			37.4			1.470
E	15.2		16.68	0.598		0.657
e		2.54			0.100	
e3		33.02			1.300	
F			14.1			0.555
i		4.445			0.175	
L		3.3			0.130	

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